CHBE 495: Preparing for Success in Science and Engineering PhD programs
Spring 2021

I. General Course Information

PhD programs in science and engineering seek to develop students' ability to conduct independent and creative scientific research. However, undergraduate engineering programs generally do not sufficiently prepare students for success in PhD programs. Writing, presenting, teaching, and idea generation are all critical skills that are under-emphasized in undergraduate science and engineering programs. Other skills that are important include the ability to propose and form research collaborations, learning how to connect with the broader network of researchers, and seeking out resources and opportunities available. Additionally, many undergraduate students do not understand graduate program application processes and are unaware of fellowship opportunities.

CHBE495 is aimed towards undergraduate students considering pursuing a PhD in science and engineering. The course will emphasize writing, giving oral presentations, critically evaluating the research literature, and proposing new ideas. Additionally, the course will give an overview of the PhD program application and evaluation process, opportunities available to graduate students such as fellowships and scholarships, and career opportunities for PhD students in science and engineering. Students are not required to be currently or have been previously involved in undergraduate research. The list below includes a limited set of topics/lectures that would be explored in the class:

- Why get a PhD in Science/Engineering?
- What is the purpose of PhD programs?
- What is expected of students in PhD programs?
- What is the application process like?
- How do I write an effective personal statement?
- How do I pick the right school?
- How do I pick a research group?
- How do I write a scientific paper?
- How do I make the most of seminars and conferences?
- How do I make professional figures and schematics?
- How do I give a professional oral presentation?
- How do I pursue a career in academia?
- How do I pursue a career in industry?
- How do I write an effective fellowship or award application?
- How to make the most of seminars
- How to make the most of conferences
- How to make professional figures and schematics
- How to give an oral presentation
- How to pursue a career in academia
- How to pursue a career in industry

The course will include weekly assignments in the form of reports, written proposals and articles, reviews, presentation, and in-class discussion and participation. Students that enroll in this course should come away with a clear understanding of the challenges and expectations of PhD programs in the sciences and engineering.

Class Time: 1:00 – 1:50 PM on Wednesdays and Fridays. All lectures will be recorded and online. Some in-person instruction will be made available if there is interest.

II. Teaching Staff

Prof. Rafael Verduzco, Office located in Keck Hall room 212. Phone: x 6492. Email: rafaelv@rice.edu. Prof. Verduzco will hold office hours immediately after class and by appointment.

Prof. Verduzco is a graduate from Rice (BS 2001) and the California Institute of Technology (PhD 2007). During his PhD studies, Verduzco received support from the National Defense Science and Engineering Graduate (NDSEG) graduate fellowship program. After completing his PhD, Verduzco worked as a Postdoctoral Researcher at Oak Ridge National Laboratory before beginning his independent research career at Rice in July 2009 in the CHBE department. Verduzco leads a research group focused on polymeric materials (polymers.rice.edu), and his research combines both techniques in polymer chemistry and physics.

Prof. Verduzco has extensive experience in evaluating applicants to PhD programs and working with PhD students. Prof. Verduzco currently chairs the Graduate Recruiting Committee for CHBE, and he chaired the Admissions Committee for over 5 years. In this position, he evaluates applicants to the CHBE PhD, MCHE, and MS program annually. Prof. Verduzco has also reviewed applications to the National Science Foundation Graduate Research Fellowship Program (GRFP). He has advised or co-advised 23 PhD students

III. Dual Mode Teaching

This class will be taught primarily online via Zoom. Lectures will be conducted using a webcam and microphone and a tablet for lecture notes. However, depending on the interest, Prof. Verduzco will make himself available for in-person instruction and/or office hours.

IV. Course Goals and Outcomes

The goal of this course it to prepare students for PhD programs in science and engineering. The course will address the following topics:

- Introduction and Overview of Graduate Programs in Science and Engineering
- Scientific Writing
    - Research Paper
    - Graduate application
    - Fellowship Application
    - Proposal
    - Others: letters of recommendation, different types of writing, e.g. reviews, perspective, overviews, project updates and reports
- Applying to Graduate School and to fellowship programs
- Attending, understanding, and benefitting from Department Seminars
- Generating Research Ideas: How do you come up with good, valuable ideas?
- Collaborations: how are they created, who do they benefit, and why collaborate?
- Teaching: the role of classroom instruction and mentoring in PhD programs
- Writing Proposals: What is the role of PhD students in proposal writing, and what does it involve?
- Scientific presentations: What are the basic elements of a quality presentation
- Preparing figures – how do you prepare professional scientific figures? Why does this matter?
- Reading the literature – what are the best ways to stay up-to-date in a field? Why is this important?

V. Class Schedule

Week	Presentation/Discussion Topic	Writing/Communication Topic	Reading/Writing Assignment
1	Why Graduate School? Overview of graduate programs in science and engineering and what they offer; Presentation and discussion of motivations for pursuing graduate degrees in engineering	Introduction to technical writing, proper word choice	Exercises
2	Scientific writing: Discussion and overview of writing in sciences and engineering. Why are publications values, and what do we accomplish by publishing our work? What types of documents will be expected, and what is the basic structure of scientific writing? Discussion and practice with scientific writing will continue throughout the course, with weekly assignments and lectures.	Word Location	Exercises
3	Conducting research: what are the expectations of PhD students, and how does this differ between groups? How collaborative is research, and how independent are PhD students expected to be? What is the purpose of academic research?	Common Grammar mistakes; from Words to Sentences	Exercises
4	Applying to Graduate School and Fellowships: How do you choose a school? How do you find and apply for fellowships? What is expected in a fellowship application? How are applications evaluated? Tips on applying and getting your application noticed	From Sentences to Paragraphs	Exercises
5	Generating research ideas: Where do research ideas come from, and what are tips and strategies for coming up with new ideas? How and why do collaborations happen?	Outlining and writing a draft	Exercises
6	What is the purpose of scientific presentations? What makes a “good” scientific presentation?	References and Plagiarism	
7	How do we make scientific Figures? What are tips and strategies for making Figures? What software and programs are available?	Figures and Tables	
8	Do I have to teach as a graduate student? What do I need to be aware of or learn to teach?	Structure of Research Papers: Introduction	

9	All about proposals – what are they, how are they written and evaluated, and do I have to write one?	Structure of Research Papers: Materials and Methods	
10	All about peer review – how does the system work for journal articles and proposals? What should I be aware of?		
11	Additional Topics		
12	Additional Topics		
13	Additional Topics		
14	Additional Topics		
15	Additional Topics		

VI. Textbook and Resources

This is subject to change, but currently no textbook is required. Discussions of reading and writing will rely heavily on the following sources:

Graff, G.; Birkenstein, C. *They Say / I Say : The Moves That Matter in Academic Writing*; W. W. Norton & Company, 2014. ISBN: 978-0-393-93584-4 (paperback)

Hofmann, A. H. *Scientific Writing and Communication*; Oxford University Press, 2020. ISBN: 978-0-190-06328-3 (paperback)

VII. Course Website

Course content will be posted on Canvas (https://canvas.rice.edu/courses/32551). This site will be used to make announcements and post handouts, homework assignments, lecture notes, and grades. All students registered for the course should automatically have access to this site. Students that do not have access to the site should contact Prof. Verduzco for access.

VIII. Grading

Grading will be determined based on your performance in homework assignments. There will be no exams. A grade scale will be used to determine your final letter grade. Note that the following scale is approximate and may be revised before the end of the semester:

		B+	87	C+	80		
A	93	B	85	C	77	D:	60
A-	90	B-	83	C-	70		

The table shows the minimum score you must obtain to get the corresponding grade. For example, if you finish with 86%, you will receive a B.

IX. Honor Code Policy

Homework in this course is a valuable tool for helping you learn and retain the information taught in the course. You are encouraged to work together on the homework, but copying is not allowed. Each student will be responsible for turning in a copy of his or her own work. Any suspicion of honor code violations for homework, quizzes, or exams will be reported to the Rice Honor Council. Information about the Rice Honor System can be found at http://honor.rice.edu/

X. Accommodations
Any student with a documented disability seeking academic adjustments or accommodations is requested to speak with me during the first two weeks of class. Students with disabilities are also encouraged to contact disability support services (https://dss.rice.edu/) in the Allen Center, room 111.

XI. Responsible Employee Notification

Rice University cares about your wellbeing and safety. Rice encourages any student who has experienced an incident of harassment, pregnancy discrimination or gender discrimination or relationship, sexual, or other forms interpersonal violence to seek support from The SAFE Office.

At Rice University, unlawful discrimination in any form, including sexual misconduct, is prohibited under Rice Policy on Harassment and Sexual Harassment (Policy 830) and the Student Code of Conduct. As the instructor and a responsible employee, I am required by Title IX to disclose all incidents of non-consensual interpersonal behaviors to the Title IX Coordinator on campus. Although responsible employees are required to make this notification, it is the student?s choice to pursue a formal complaint. The goal is to make sure that students are aware of the range of options available and have access to the resources when in need. For more information, please visit safe.rice.edu, titleix.rice.edu, or email titleixsupport@rice.edu.